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Cost of providing emergency obstetric care in Tanzania's Kigoma region

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Summary

Background: The provision of Emergency Obstetric and Neonatal Care (EmONC) is critical for reducing maternal mortality, yet little is known about the costs of EmONC services in developing countries. This study estimates these costs at six health facilities in Tanzania's Kigoma region.

Methods: The study took a comprehensive programmatic approach considering all sources of financial and in-kind support over a 1-year period (1 July 2012 to 30 June 2013). Data were collected retrospectively and costs disaggregated by input, sources of support, programmatic activity, and patient type (nonsurgical, surgical patients, and among the latter patients undergoing caesarean sections).

Results: The median per-patient cost across the six facilities was \$290. Personnel and equipment purchases accounted for the largest proportions of the total costs, representing 32% and 28%, respectively. Average per-patient costs varied by patient type; cost per nonsurgical patient was \$80, \$258 for surgical patients and \$426 for patients undergoing caesarean sections. Per-patient costs also varied substantially by facility type: mean per-patient cost at health centres was \$620 compared with \$169 at hospitals.

Conclusions: This study provides the first cost estimates of EmONC provision in Kigoma. These estimates could inform programme planning and highlight areas with potential scope for cost reductions.

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AUTHOR CONTRIBUTIONS

T.M., A.B., A.K., M.S. and R.K. contributed to the concept and design of the study. T.M., M.S., R.K. and G.M. contributed to the field data collection. T.M., A.K. and A.B. conducted the analysis and T.M. drafted the first version of the manuscript. A.B. provided a critical review of the article. All authors reviewed and approved the final manuscript.

DISCLAIMER

The findings and conclusions in this study are those of the authors and do not necessarily represent the official position of the US Centers for Disease Control and Prevention.

ETHICS STATEMENT

The protocol was reviewed and approved by the US Centers for Disease Control and Prevention (CDC) and the National Institute for Medical Research (NIMR) in Tanzania.

Keywords

maternal health; emergency obstetric care; cost; Tanzania

1 | BACKGROUND

As part of the Sustainable Development Goals (SDGs), developing countries committed to reducing maternal mortality to less than 70 deaths per 100 000 births by 2030. The United Republic of Tanzania currently has one of the highest maternal mortality rates in the world with an estimated maternal mortality ratio (MMR) of 398 per 100 000 live births in 2015. While this represents a substantial improvement from the MMR in 1990 (870 per 100 000 live births), it is still a far reach from its Millennium Development Goals (MDGs) target of 193 per 100 000 live births by 2015.^{1,2}

The provision of Emergency Obstetric and Neonatal Care (EmONC) is a critical intervention for reducing maternal mortality.³ In Tanzania, maternal complications have, in part, been attributed to the fact that only 64% of all pregnant women deliver with the help of a skilled health worker be it a doctor, clinical officer, nurse, midwife, or maternal and child health aide.² Research has shown that the main barriers to the use of obstetric care in Tanzania are the availability of critical services, quality care, and qualified staff rather than pregnant women's lack of knowledge or inability to get to the facilities providing such care.⁴⁻⁸

Providing EmONC entails having trained personnel, equipment, medicines, and supplies, which in-turn requires resources. However, the resource requirements for EmONC provision in developing countries are not well understood as only a few studies have attempted to measure these. Cost analyses that undertake systematic collection of programme costs are important because these studies can inform current and future budgetary allocation to EmONC as well as provide information that would indicate potential areas for cost savings. In the context of resource constraints, combined with effectiveness assessment measures, such analyses can inform the trade-offs that policymakers have to make in allocating resources to EmONC compared with other alternative interventions aiming to reduce maternal mortality.⁸

The study aims to contribute to the limited evidence base by examining the costs of EmONC provision in the Kigoma region of Tanzania. The primary objectives were to assess the average per-patient cost of providing these services and to better understand the composition and drivers of these costs in different settings and geographies. The protocol was reviewed and approved by the US Centers for Disease Control and Prevention (CDC) and the National Institute for Medical Research (NIMR) in Tanzania.

2 | METHODS

2.1 | Population and study sites

The population of interest for the study was pregnant women with direct obstetric complications receiving care in EmONC sites across the Kigoma region. Located in Western Tanzania, the region is predominantly rural and has an estimated population of 2.1 million.

At 6.7 children per woman, it also has the highest fertility rate in Tanzania and its maternal and child health indicators rank among the lowest in the country: Only 47% of deliveries are attended by a skilled provider, and 46% of all deliveries occur in a health facility. Furthermore, the caesarean section rate—a measure of access to common obstetric interventions—was at 4% in 2015 to 2016, below the WHO-recommended minimum threshold of 5%.⁴

The study sites were selected among facilities supported by the Project to Reduce Maternal Deaths in Tanzania, an initiative supported by Bloomberg Philanthropies aimed at improving access to EmONC throughout Tanzania. Since 2006, the project has supported 15 health facilities across the country (nine of which are located in the Kigoma region) providing infrastructure upgrades including building or renovating operating theatres, maternity wards, staff housing, and lab facilities; providing essential EmONC supplies, medicines, and equipment; and training nonphysician clinicians in EmONC skills and anaesthesia administration.

Effectively, three health centres and three hospitals were purposively sampled among project supported health facilities in the Kigoma region (Table 1). Taking into consideration the accessibility of sites, facilities were selected to capture variations in costs across different types of facilities (health centres and hospitals) and different districts of the Kigoma region (Kibondo, Kasulu, and Kigoma Urban).

2.2 | Study design and analysis

The study took a programmatic perspective and used a case-mix approach, estimating the average cost of a disease or intervention by category of patients. Two categories of patients were identified: those undergoing a nonsurgical procedure and those undergoing a surgical procedure. Additionally, since caesarean sections are the most common surgical procedure, the study separately estimated the per-patient costs for patients undergoing a caesarean section. To better understand the cost breakdown across programme activities (eg, clinical care and lab services) and input types (eg, drugs and personnel), the collected data were tagged along two dimensions: the portion of total costs devoted to a specific programme activity (six categories) and the portion of total costs devoted to an input type (12 categories). For the latter, the costs were further categorized into recurrent (eight categories) and investment (three categories) expenses (Table 2).

Economic costs were estimated in order to generate a measure of the long-term cost of providing EmONC. The value of nonmonetary outlays (eg, volunteer time and donated items) were therefore estimated and included. In addition, following the literature on economic evaluation of health care interventions, investment purchases were annualized over the expected useful life—3 years for training, 5 years for equipment, and 30 years for buildings—using a discount rate of 3% per annum.^{9,10} The opportunity cost of using existing buildings was estimated as the equivalent rental cost of the building space. Depending on the input type, shared costs between EmONC and other clinical services were attributed to EmONC by direct allocation either on the basis of reported percentage effort of personnel (for facility maintenance, administrative, and managerial overhead) or reported percentage use (for building use, utilities, and new infrastructure).

To assess the per-patient costs, recognizing that these may vary by the complexity of the EmONC procedure received, the allocation of clinical care across the different patient types was assessed through key informant interviews. Further, for other programmatic activities that were expected to vary in resource use between surgical and nonsurgical patients—specifically, training and supervision, general administration and operations, and laboratory services—the costs were weighted by the average number of days each patient type stays at the facility.

2.3 | Data

Comprehensive data on the total costs incurred to provide EmONC in the six facilities during the 1-year period between 1 July 2012 and 30 June 2013 were collected, taking into account all financial and in-kind support. Data were collected retrospectively over 3 weeks in October to November 2013 through a review of financial and programme records (clinical registrars, log books, and pharmacy stock cards) and interviews of key personnel supporting or managing the EmONC sites. Nonfacility-based costs that contributed to the outlays to provide EmONC at the six sites (eg, salaries for programme staff in Dar es Salaam) and blood supply chain costs were excluded, as were productivity effects and costs incurred by patients. All financial information was collected in Tanzanian Shillings (TZS) and converted to 2013 US Dollars (USD). All the analyses were conducted using Stata SE 12 statistical software package.

3 | RESULTS

The median annual economic costs per EmONC patient across the six facilities was \$290.43 (2013 USD), with the average cost per surgical patient being \$257.71 and \$80.10 for nonsurgical patients. Among surgical patients, the average cost per patient undergoing a caesarean section was \$426.03, reflecting the relatively higher resources requirements of the procedure. Overall, clinical care represented the largest outlay by programme area, accounting for approximately 45% of total costs, followed by general administrative and operations costs (21%) and training and supervision (19%) (Table 3). In terms of the breakdown by input type (Table 4), recurrent costs represented the bulk of the costs (60%) with personnel in particular accounting for 32% of the total cost. Equipment purchases accounted for the second largest cost by input type (28%).

The per-patient economic costs and cost structure varied substantially by facility type. The average per-patient cost was higher for health centres (\$620.05) compared with hospitals (\$168.87). The hospitals' cost structure was dominated by recurrent costs (79%) while that of the health centres was dominated by investment costs (57%). By the same token, personnel accounted for almost 40% of total costs for hospitals compared with 16% at the health centres, while equipment purchases in hospitals represented 17% of the total costs compared with 46% of total per-patient costs in health centres. The difference is explained, in part, by patient volume, with low-volume facilities having higher per-patient costs compared with higher-volume facilities (Figure 1), reflecting the fact that health centres may be operating below capacity.

The difference is also a function of the differentiated levels of support received by health centres and hospitals and the timing of the interventions. In general, the health centres in the sample were equipped a year later than the hospitals, and being located in more remote areas and less well endowed, health centres got additional equipment such as generators, solar panels, and motorcycles for staff. Over time, health centres also received additional supportive supervision visits.

4 | DISCUSSION

The literature on the cost of providing EmONC services in developing countries is scarce. An extensive search of the peer-reviewed and grey literature on cost studies of EmONC provision yielded nine studies. All nine used a microcosting approach to cost-specific EmONC procedures—mostly caesarean sections—but two studies^{11,12} explored, in addition, the cost of postabortion care, postpartum haemorrhage, and eclampsia (Table 5). To our knowledge, this is the first study to estimate the cost of providing comprehensive EmONC as a package of services in a developing country context. From the policy perspective, thinking of EmONC as the provision of a bundle of services and understanding the resource requirements of the package of services provides valuable input to policymakers for current and future budgetary allocation to EmONC.

By costing comprehensive EmONC provision in both hospitals and health centres, the study also contributes to existing knowledge on differential costs of providing EmONC in various health care settings. In predominantly rural areas across the developing world where access to EmONC services has been identified as a key barrier to seeking care, understanding the potential costs of establishing such services in lower level health facilities in addition to tertiary facilities is important for donors and governments as it would enable the consideration of geographic allocation of EmONC services in the context of the needed resources to establish them.

Related to this, our results highlight the significance of patient volume as a driver of per-patient costs of EmONC and the need to attract a sufficient number of patients to health care centres to improve efficiency in EmONC provision in those sites. Our results suggest that interventions such as improvements in the referral systems from health dispensaries and/or investments in emergency transport systems could potentially be good complements to interventions that aim to upgrade facilities in low-density areas to provide comprehensive EmONC.

In interpreting the results of the study, it is important to keep in mind some of its limitations. First, since the study sites were purposefully sampled from facilities that had received support from the Project to Reduce Maternal Deaths in Tanzania, our estimates may not be representative of the costs of providing EmONC throughout the Kigoma region, nor Tanzania as a whole. This is a general weakness of the overall evidence base on costing EmONC in developing countries. Indeed, as shown in Table 5, the existing evidence base generally rests on data collected from a small set of purposively selected facilities. In order to have truly generalizable results, studies would need to cost the provision of EmONC

provision at an adequate number of randomly selected sites across the region/country of interest.

Second, we acknowledge that while the study attempted to be as comprehensive as possible in covering all costs, some costs were excluded because of the unfeasibility of collecting the data. These include all the costs that were not borne at the facilities themselves, in particular, staff housing and salaries for programme staff in Dar es Salaam. Furthermore, the analysis was conducted purely from the provider perspective and did not include the costs borne by individual patients in receiving EmONC services, the productivity losses related to maternal morbidity associated with EmONC, and the potential cost savings arising from the effect of EmONC in reducing maternal morbidity and mortality.

Finally, we note that the study focused on the costs of providing EmONC services and not treatment outcomes. As a result, the estimates do not fully capture potential treatment quality differences (eg, outcomes of CS or surgical procedures) nor do they capture the value of providing EmONC services given that pregnancy complications are generally unpredictable and a large proportion are nonpreventable and happen during labour or childbirth. Combining the cost data with outcome data such as maternal deaths averted to conduct a cost-effectiveness analysis would add an important layer of knowledge that would better guide resource allocation decisions.

5 | CONCLUSIONS

The provision of EmONC services entails a given package of interventions, and understanding the resource requirements for these is important from the policy perspective. Thus, aligning the research questions of EmONC cost studies to include certain bundles of interventions (eg, basic and comprehensive emergency obstetric health services) would increase the value of the findings for policymakers and donors who often have to make decisions on whether to provide certain types of EmONC services over others given their scarce resources. Our study makes a contribution in that direction by providing estimates of per-patient costs of comprehensive EmONC provision in two types of health care facilities in the Kigoma region of Tanzania. These estimates can be used to inform budgeting, as well as to provide information on areas where there may be scope for reductions in per-patient costs through programmatic efficiencies.

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Key Messages

- **Implications for policymakers**

The study results provide two key insights for policy makers. First, thinking of emergency obstetric care as the provision of a bundle of services and understanding the resource requirements of the package of services provides valuable input to policymakers for current and future budgetary allocation to emergency obstetric care. Second, our results show that patient volume is a significant driver of per-patient costs. This suggests, under resource constraints, that interventions such as improvements in the referral systems from health dispensaries and/or investments in emergency transport systems could increase the efficiency of emergency obstetric care provision in low-density areas.

- **Implications for public**

The provision of Emergency Obstetric and Neonatal Care (EmONC) is a critical intervention for reducing maternal mortality, and increasing access to such services, particularly in developing countries, can dramatically reduce deaths from pregnancy complications. The results of this study point to potential efficiency gains that could improve the use of resources in the provision of EmONC services, thereby potentially freeing up resources for additional and/or improved services.

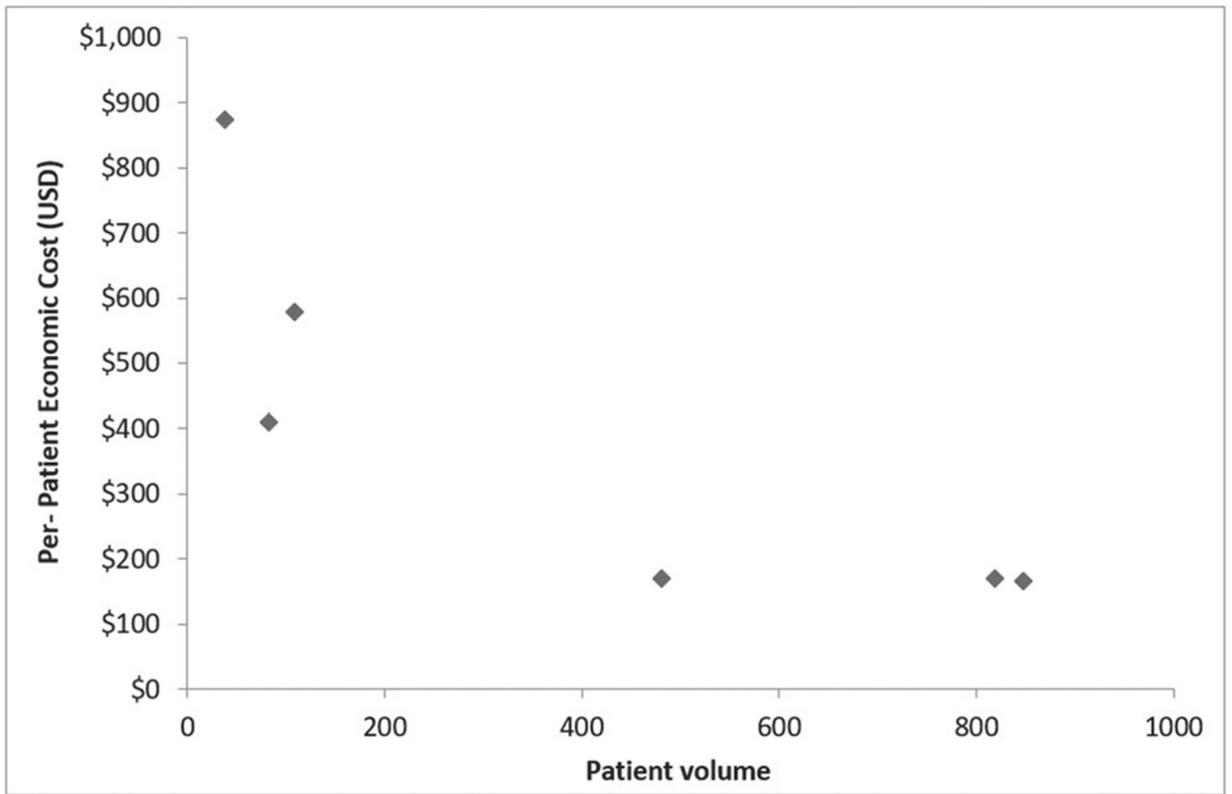


FIGURE 1.
Per-patient costs by patient-volume (Economic Costs, 2013 USD)

TABLE 1

Study sites

District	Health Facility	Health Facility Type	Number of Deliveries (2012)	Number of EmONC Patients (July 2012 to June 2013)
Kibondo	Kakonko Health Centre	Health centre	1598	108
	Mabamba Health Centre	Health centre	1049	82
	Kibondo District Hospital	Hospital	2853	480
Kasulu	Nyenge Health Centre	Health centre	423	37
	Kasulu District Hospital	Hospital	5471	819
Kigoma Urban	Maweni Regional Hospital	Hospital	2512	847

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TABLE 2

Cost categorization matrix

Programme Activity Categories	Input Types Categories	
	Recurrent Expenses	Investments
1. Training and supervision	1. Personnel	9. Equipment
2. Clinical care	2. Drugs	10. New infrastructure
3. Laboratory services	3. Supplies	11. Training and Supervision
4. Supply chain management	4. Building use	
5. Monitoring and evaluation (M&E) and health management information systems (HMIS)	5. Travel	
6. General administration and operations	6. Utilities	
	7. Contracted services	
	8. Blood supplies	

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TABLE 3

Median annual economic costs by programme activity

Programme Activity	Median Cost (USD 2013)	Proportion of Total Cost, %
Clinical care	130.04	44.77
General administration and operations	59.95	20.64
Training and supervision	54.39	18.73
Laboratory	8.79	3.03
Supply chain	1.19	0.41
M&E and HMIS	3.53	1.22
Total	290.43	100

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TABLE 4

Median annual economic costs by input type

Input Type	Median Cost (USD 2013)	Proportion of Total Cost, %
All recurrent cost	173.38	60
Personnel	93.12	32
Contracted services (supervision)	31.97	11
Drugs	6.24	2
Other supplies	25.93	9
Diesel	10.21	4
Contracted services (equipment maintenance)	7.65	3
Building use	4.63	2
Utilities	2.44	1
Blood supplies	0.64	0
Contracted services (other)	1.04	0
All investments	114.29	39
Equipment	81.38	28
New buildings and renovation	11.54	4
Training	8.38	3
Total	290.43	100

TABLE 5

Costs of EmONC—results from the literature

Obstetrical Complications							
	Comprehensive EmONC Provision	Caesarean Deliveries	Postabortion Care	Postpartum Haemorrhage	Eclampsia	Country	Number of Facilities in Sample
Our estimates	\$290.43	\$426.03				Tanzania	6 facilities
Deboutte et al ¹³		\$169.33				Congo, Dem. Rep.	4 hospitals
Khan et al ¹⁴		\$393.12				Pakistan	1 hospital
Alam et al ¹⁵		\$125.14				Bangladesh	1 hospital
Chankova et al ¹¹		\$4.60-\$22.60	\$3.50-\$19.40	\$2.60-\$4.40	\$7.80-\$17	Bangladesh	18 health facilities
Gibbons et al ¹⁶		\$212				54 countries	N/A
Houton et al ¹⁷		\$217-\$577				Burkina Faso	22 hospitals
van Booth et al ¹⁸		\$82.83				Tanzania	1 hospital
Borghi et al ¹⁹		\$706.86				Argentina	2 hospitals
Levin et al ¹¹		\$75-\$138	\$27-\$89	\$8-\$157	\$71-\$218	Uganda, Malawi, Ghana	2 hospitals in each country